## CLAIMS

1. Method for processing a sound field representation in order to provide a representation modified by the application of this processing corresponding to at least spatial processing of the sound field, comprising:

- the establishment (8) of an initial representation of the sound field in the form of a set of coefficients representative of that field in time and in the three spatial dimensions; and

- the establishment (10) of a representation modified by filtering combinations that correspond to the processing operation and that are applied to the coefficients of the initial representation,

characterized in that it also comprises a step (2) of defining the processing operation, which step comprises:

- a step (4) of establishing a set of directivity functions which is representative of the processing operation, in the form of a set of coefficients corresponding to the decomposition of those functions on a basis of spherical harmonics; and

- a step (6) of determining the filtering combinations on the basis of that decomposition for the implementation of a step (10) of applying the filtering combinations so defined to the coefficients of the initial representation, in order to obtain the modified representation.

2. Method according to claim 1, characterized in that the step (4) of determining a set of directivity functions comprises a sub-step (12) for the direct determination of all or part of the set of directivity functions in one or other of a plurality of predetermined formats.

3. Method according to either claim 1 or claim 2, characterized in that the step (4) of determining a set of directivity functions comprises a sub-step (16) for the automatic interpretation of a processing instruction permitting the automatic provision of all or part of the set of directivity functions in one or other of a plurality of predetermined formats, on the basis of the processing instruction.

4. Method according to any one of claims 1 to 3, characterized in that the set of directivity functions which is representative of the processing operation is expressed in accordance with one or other of a plurality of predetermined formats and in that the step (4) of establishing a set of directivity functions comprises a sub-step (18) of conversion, from the predetermined format, into a

set of coefficients corresponding to the decomposition of those directivity functions on a basis of spherical harmonics.

5. Method according to any one of claims 1 to 4, characterized in that the step (2) of defining the processing operation also comprises a step (20) of establishing a set of parameters for that processing operation.

6. Method according to claim 5, characterized in that the set of parameters comprises all or some of the following parameters:

- a set of constants ($c_{l,m,l',m'}^{l',m'}$) forming weighting coefficients and defined as a function of the nature of the processing operation; and

- a parameter (L) specifying the limit order of operation of the method and corresponding to the desired mathematical precision limit.

7. Method according to either claim 5 or claim 6, characterized in that the step (20) of establishing a set of parameters comprises a sub-step (22) for the direct determination of all or part of the set of parameters.

8. Method according to any one of claims 5 to 7, characterized in that the step (20) of establishing a set of parameters comprises a sub-step (26) for the automatic interpretation of a processing instruction permitting the automatic provision of all or part of the set of parameters on the basis of that processing instruction.

9. Method according to any one of claims 6 to 8, characterized in that the step (20) of establishing a set of parameters comprises a sub-step of calculating all or part of the set of constants as a function of the nature of the processing operation.

10. Method according to any one of claims 1 to 9, characterized in that the step (6) of determining the filtering combinations comprises at least one sub-step (30) of calculating filtering combinations by means of linear combinations of the coefficients corresponding to the spherical harmonic-based decomposition of the set of directivity functions which is representative of the processing operation.

11. Method according to claims 6 and 10 taken together, characterized in that the sub-step (30) of calculation by means of linear combinations uses the set of constants as weighting coefficients.

12. Method according to either claim 10 or claim 11, characterized in that the result of the calculation sub-step (30) forms directly the filtering combinations that are to be applied to the coefficients of the initial representation.

13. Method according to claim 12, characterized in that the processing is convolution processing.

14. Method according to claim 12, characterized in that the processing is windowing processing.

15. Method according to any one of claims 1 to 11, characterized in that the processing comprises at least one distortion to be applied to the initial sound field representation, and in that all or some of the directivity functions determined during the step (4) of establishing a set of directivity functions form a set of distortion pairs which is representative of the distortion, in the form of a set of coefficients corresponding to the decomposition of the distortion pairs on a basis of spherical harmonics.

16. Method according to claims 10 and 15 taken together, characterized in that the processing comprises a first processing operation, which is referred to as nominal, and the distortion(s), the calculation sub-step (30) providing filtering combinations corresponding to the nominal processing and the step (6) of determining filtering combinations also comprising at least one sub-step (50) of distortion by modifying the filtering combinations provided by the calculation sub-step (30), on the basis of the distortion pairs representative of the distortion(s), in order to provide the filtering combinations that are to be applied to the coefficients of the initial representation.

17. Method according to claims 5 and 16 taken together, characterized in that the set of parameters comprises a parameter ($\lambda$) representative of the distortion effort, that is to say, specifying the resemblance between the processing to be applied and the nominal processing.

18. Method according to claim 15, characterized in that the processing comprises solely distortion(s), the step (6) of determining the filtering combinations comprising at least one distortion sub-step (50) providing filtering combinations solely on the basis of the distortion pairs representative of the distortion(s), in order to provide the filtering combinations that are to be applied to the coefficients of the initial representation.

19. Method according to any one of claims 16 to 18, characterized in that it comprises a plurality of distortion sub-steps (50) which are recursive with respect to one another, so that each distortion sub-step (50) receives as an input the filtering combinations provided by the preceding sub-step.

20. Method according to any one of claims 16 to 19, characterized in that the at least one distortion sub-step (50) permits the determination of the filtering combinations corresponding to modifications to be carried out on portions of the initial representation that are not directly targeted by the distortion pairs.

21. Method according to any one of claims 10, 16 and 18, characterized in that the processing is split into a plurality of elemental processing operations and in that at least the step (6) of determining filtering combinations is repeated a plurality of times, the filtering combinations resulting from the various calculation (30) and/or distortion (50) sub-steps and corresponding to the elemental processing operations being arranged amongst one another to form the filtering combinations that are to be applied to the coefficients of the initial representation.

22. Method according to any one of claims 1 to 21, characterized in that the step (6) of determining the filtering combinations comprises a sub-step (32) of converting the filtering combinations represented in a predetermined format to provide filter parameters suitable for the parameterization of given filters with a view to performing the step (10) of applying the filtering combinations.

23. Method according to any one of claims 1 to 22, characterized in that the processing is spatial processing and in that the step (10) of applying the filtering combinations comprises gain modifications applied to the coefficients of the initial representation.

24. Method according to any one of claims 1 to 23, characterized in that the processing is spatial and frequency processing and in that the step (10) of applying the filtering combinations comprises the application of filters varying as a function of the frequency to the coefficients of the initial representation.

25. Method according to any one of claims 1 to 24, characterized in that the sets of coefficients representative of the initial sound field representation and of the modified representation are sets of coefficients called Fourier-Bessel coefficients.

26. Device for processing a sound field representation in order to provide a representation of the sound field by applying this processing corresponding to at least spatial processing of the sound field, the device (60) receiving as an input an initial representation of the sound field in the form of a set of coefficients which is representative of that field in time and in the three

spatial dimensions and providing as an output a representation modified by the filtering combinations corresponding to the processing applied to the coefficients of the initial representation, characterized in that it comprises means (61) of defining the processing operation, comprising:

- means (62, 64, 66) of establishing a set of directivity functions which is representative of the processing operation, in the form of a set of coefficients corresponding to the decomposition of those directivity functions on a basis of spherical harmonics; and

- means (70) of determining the filtering combinations on the basis of that decomposition, for their use by filtering means (80) receiving the coefficients of the initial representation as an input and providing the modified representation as an output.

27. Device according to claim 26, characterized in that the means (61) of defining the processing operation comprise a module (62) for the direct acquisition of operating data for the device in one or other of a plurality of formats.

28. Device according to either claim 26 or claim 27, characterized in that the means (61) of defining the processing operation comprise a module (64) for the automatic interpretation of a processing instruction enabling operating data to be provided automatically in one or other of a plurality of predetermined formats.

29. Device according to either claim 27 or claim 28, characterized in that the operating data comprise the set of directivity functions which is representative of the processing operation.

30. Device according to claim 29, characterized in that the means (61) of defining the processing operation comprise a conversion module (66) suitable for converting the set of directivity functions from one or other of a plurality of predetermined formats into a set of coefficients corresponding to the decomposition of those directivity functions on a basis of spherical harmonics.

31. Device according to either claim 27 or claim 28, characterized in that the operating data comprise a set of parameters for the processing operation.

32. Device according to claim 31, characterized in that the means (61) of defining the processing operation comprise a module for calculating all or part of the set of parameters as a function of the nature of the processing operation.

33. Device according to any one of claims 26 to 32, characterized in that the means (70) of determining the filtering combinations comprise a module (72) for calculating filtering combinations by linear combinations of the coefficients corresponding to the spherical harmonic-based decomposition of the directivity set representative of the processing operation.

34. Device according to claims 31 and 33 taken together, characterized in that the set of processing parameters comprises a set of constants and in that the module (72) for calculation by linear combinations uses that set of constants as weighting coefficients.

35. Device according to any one of claims 26 to 33, characterized in that the processing operation comprises at least one distortion, all or part of the set of directivity functions forming a set of distortion pairs corresponding to the distortion(s) to be applied to the initial representation, and in that the means (70) of determining the filtering combinations also comprise a module (74) for distortion by modification of the filtering combinations provided by the calculation module (72), on the basis of the distortion pairs, in order to provide the filtering combinations that are to be applied to the coefficients of the initial representation.

36. Device according to any one of claims 26 to 32, characterized in that the processing operation comprises solely one or more distortions, all or part of the set of directivity functions forming a set of distortion pairs corresponding to the distortion(s) to be applied to the initial representation, and in that the means (70) of determining the filtering combinations comprise solely a distortion module (74) in order to provide the filtering combinations solely on the basis of the distortion pairs.